PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
116729		
International Application No.	International Filing Date *(day/month/year)*	Priority Date *(day/month/year)*
PCT/NZ2003/000289	22 December 2003	6 January 2003

International Patent Classification (IPC) or national classification and IPC

Int. Cl. [7] C25F 1/00, 3/16

Applicant

AUCKLAND UNISERVICES LIMITED et al

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of **6** sheet(s).

3. This report contains indications relating to the following items:

   - I [X] Basis of the report
   - II [ ] Priority
   - III [ ] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV [ ] Lack of unity of invention
   - V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI [ ] Certain documents cited
   - VII [ ] Certain defects in the international application
   - VIII [ ] Certain observations on the international application

Date of submission of the demand	Date of completion of the report
12 July 2004	18 April 2005
Name and mailing address of the IPEA/AU	Authorized Officer
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/NZ2003/000289

I. Basis of the report

1. With regard to the elements of the international application:*

☐ the international application as originally filed.

☒ the description, pages **4-11,** as originally filed,
pages , filed with the demand,
pages **1-3,** received on **28 September 2004** with the letter of **23 September 2004**

☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages **12-14,** received on **28 September 2004** with the letter of **23 September 2004**

☒ the drawings, pages **1-5,** as originally filed,
pages , filed with the demand,
pages , received on with the letter of

☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/fig.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims		**YES**
	Claims	**1-20**	**NO**
Inventive step (IS)	Claims		**YES**
	Claims	**1-20**	**NO**
Industrial applicability (IA)	Claims	**1-20**	**YES**
	Claims		**NO**

2. Citations and explanations (Rule 70.7)

D1: US 4810343

D2: GB 2203756

D3: GB 2101731

NOVELTY & INVENTIVE STEP

The attorney has amended the claims so that they are characterised by the feature that the component being cleaned may be switched from being the anode to cathode. This feature is clearly disclosed in D1 at page 2 line 7. The attorney has argued that this citation does not disclose in-situ cleaning .We disagree with this. The description and claims clearly state the invention is for a mobile localized electrolytic surface treatment which in our view is in situ cleaning. Further citations D2 &D3 also disclose in situ cleaning and may be combined with D1 to render claim 1 lacking an inventive step. Also D3 at page 2 indicates the current may be AC or DC and it is a matter of choice if a surface is the anode or cathode. This is also a disclosure that it is known to switch the component from anode to cathode (AC current does this automatically). The features of the other claims are either disclosed in the citations or do not add an inventive step.

INDUSTRIAL APPLICABILITY

The claims are directed towards a method of applying electrochemical influence to a machine component and therefore have industrial applicability.

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"Electrochemical process and apparatus"

Field of the Invention

This invention relates to the electro-chemical process of electrolysis and in particular to a process and apparatus for applying electrolysis for the in-situ polishing, cleaning and/or sterilisation of metallic surfaces.

Background to the Invention

Electrolysis is the chemical decomposition of substances, or electrolytes, by an electric current passed through the substance in a dissolved or molten state. The substances are ionized into electrically charged ions, and when an electric current is passed through them by means of conducting electrodes, the ions move towards the oppositely charged electrodes thereby giving up their electric charges to become uncharged atoms or groups, and are either liberated or deposited at the electrode or react chemically therewith.

Electrolysis has wide ranging industrial applications and is primarily used as a method of deposition at the cathode or sacrificial degradation at the anode. Electrolysis also finds application in cleaning and polishing techniques but, to date, has not been fully explored to its potential. The food industry and, in particular, the dairy industry suffers from particular problems associated with cleaning production machinery including heat exchangers. To date, machinery involved in the handling of milk and other dairy products must be shut down entirely for an extended period of time during cleaning operations. The cleaning involves flushing large amounts of caustic cleaning agents through the machines in order to remove residues build up and contamination. Acid cleaning may also be required some times. Once the cleaning is finished the machine must then be rinsed very thoroughly to remove all traces of these cleaning elements and reassembled and recommissioned. These cleaning problems are particularly associated with the cleaning and maintenance of heat exchangers, but extend to other components and also to other industries.

Summary of the Invention

According to a first aspect of the invention, there is provided a method of applying an electrochemical influence to a component of a machine, in situ, the method comprising:

connecting the component, while in situ, into an electrolysis system so that the component functions as at least one electrode of the system;

applying an electrolyte to the component;

causing current flow through the electrolyte to effect electrochemical cleaning of the component in situ; and

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periodically switching a voltage applied to the component to cause the component periodically to alternate between being an anode and a cathode of the system.

In this specification, the term "cleaning" is to be understood in a broad sense to include, unless the context clearly indicates to the contrary, polishing, sterilizing, or the like.

The method may include using a switching device in the system to cause the component to switch between functioning as the cathode and as the anode of the system.

The method may include selecting the electrolyte from the group comprising phosphoric acid and sodium hydroxide.

Further, the method may include limiting the current flow through the electrolyte by varying a voltage applied to the system.

The method may include circulating the electrolyte through the system.

According to a second aspect of the invention, there is provided a method of cleaning a bank of spaced metal objects which comprises

while the objects are in situ, making one of the objects function as a cathode of an electrolysis system and making another of the objects function as an anode of the electrolysis system;

applying an electrolyte to the objects;

applying a voltage between the object acting as the cathode and the object acting as the anode; and

periodically switching the voltage applied to the objects to cause the objects periodically to alternate between acting as the anode and the cathode of the system.

The method may include using a switching device in the system to switch the objects between functioning as the cathode and as the anode of the system.

The method may include selecting the electrolyte from the group comprising phosphoric acid and sodium hydroxide.

Further, the method include limiting the current flow through the electrolyte by varying a voltage applied to the system.

In addition, the method may include circulating the electrolyte through the system.

The objects may be plates of a heat exchanger and the method may include causing a plurality of the plates to function as the cathode and a further, different plurality of the plates to function as the anode. The method may therefore include selecting each alternate plate as a cathode with the remaining alternate plates functioning as the anode of the system.

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According to a third aspect of the invention, there is provided electrochemical cleaning apparatus which comprises

a power source;

a connecting arrangement connected to the power source, the connecting arrangement providing for the connection of a component of machinery to be cleaned, while the component is in situ, to the power source to enable the component to function as at least one electrode of an electrolysis system;

a reservoir for an electrolyte, the reservoir being coupled, in use, to a part of the machinery to apply the electrolyte to the component; and

a switching device arranged between the power source and the component to cause the component periodically to switch between functioning as a cathode and as an anode of the system.

The electrolyte may be selected from the group comprising phosphoric acid and sodium hydroxide.

The power source may comprise a variable voltage source for controlling current flow through the electrolyte.

The apparatus may include a circulating means, more particularly a pump, for circulating the electrolyte through the system.

The invention extends also to an electrochemical cleaning assembly for cleaning a bank of spaced metal objects, the assembly comprising

electrochemical cleaning apparatus as described above; and

a plurality of the objects connected to the connecting arrangement of the apparatus while the objects are in situ, so that at least one of the objects functions initially as a cathode of an electrolysis system so formed and at least one other of the objects functions initially as an anode of the electrolysis system.

The switching device may periodically switch the objects to cause the object that had been functioning as the cathode to function as the anode and vice versa.

The objects may be plates of a heat exchanger and a plurality of the plates may function as the cathode and a further, different plurality of the plates may function as the anode. Each alternate plate may function initially as a cathode with the remaining alternate plates functioning initially as the anode of the system.

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1. A method of applying an electrochemical influence to a component of a machine, in situ, the method comprising:

connecting the component, while in situ, into an electrolysis system so that the component functions as at least one electrode of the system;

applying an electrolyte to the component;

causing current flow through the electrolyte to effect electrochemical cleaning of the component in situ; and

periodically switching a voltage applied to the component to cause the component periodically to alternate between being an anode and a cathode of the system.

2. The method of claim 1 which includes using a switching device in the system to cause the component to switch between functioning as the cathode and as the anode of the system.

3. The method of claim 1 or claim 2 which includes selecting the electrolyte from the group comprising phosphoric acid and sodium hydroxide.

4. The method of any one of the preceding claims which includes limiting the current flow through the electrolyte by varying a voltage applied to the system.

5. The method of any one of the preceding claims which includes circulating the electrolyte through the system.

6. A method of cleaning a bank of spaced metal objects which comprises

while the objects are in situ, making one of the objects function as a cathode of an electrolysis system and making another of the objects function as an anode of the electrolysis system;

applying an electrolyte to the objects;

applying a voltage between the object acting as the cathode and the object acting as the anode; and

periodically switching the voltage applied to the objects to cause the objects periodically to alternate between acting as the anode and the cathode of the system.

7. The method of claim 6 which includes using a switching device in the system to switch the objects between functioning as the cathode and as the anode of the system.

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8. The method of claim 6 or claim 7 which includes selecting the electrolyte from the group comprising phosphoric acid and sodium hydroxide.

9. The method of any one of claims 6 to 9 which includes limiting the current flow through the electrolyte by varying a voltage applied to the system.

10. The method of any one of claims 6 to 9 which includes circulating the electrolyte through the system.

11. The method of any one of claims 6 to 10 in which the objects are plates of a heat exchanger and in which the method includes causing a plurality of the plates to function as the cathode and a further, different plurality of the plates to function as the anode.

12. The method of claim 11 which includes selecting each alternate plate initially as a cathode with the remaining alternate plates functioning initially as the anode of the system.

13. Electrochemical cleaning apparatus which comprises

a power source;

a connecting arrangement connected to the power source, the connecting arrangement providing for the connection of a component of machinery to be cleaned, while the component is in situ, to the power source to enable the component to function as at least one electrode of an electrolysis system;

a reservoir for an electrolyte, the reservoir being coupled, in use, to a part of the machinery to apply the electrolyte to the component; and

a switching device arranged between the power source and the component to cause the component periodically to switch between functioning as a cathode and as an anode of the system.

14. The apparatus of claim 13 in which the electrolyte is selected from the group comprising phosphoric acid and sodium hydroxide.

15. The apparatus of claim 13 or claim 14 in which the power source comprises a variable voltage source for controlling current flow through the electrolyte.

16. The apparatus of any one of claims 13 to 15 which includes a circulating means for circulating the electrolyte through the system.

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17. An electrochemical cleaning assembly for cleaning a bank of spaced metal objects, the assembly comprising

electrochemical cleaning apparatus as claimed in any one of claims 13 to 16; and

a plurality of the objects connected to the connecting arrangement of the apparatus while the objects are in situ, so that at least one of the objects functions initially as a cathode of an electrolysis system so formed and at least one other of the objects functions initially as an anode of the electrolysis system.

18. The assembly of claim 17, in which the switching device periodically switches the objects to cause the object that had been functioning as the cathode to function as the anode and vice versa.

19. The assembly of claim 17 or claim 18 in which the objects are plates of a heat exchanger and a plurality of the plates function as the cathode and a further, different plurality of the plates function as the anode.

20. The assembly of claim 19 in which each alternate plate functions initially as a cathode with the remaining alternate plates functioning initially as the anode of the system.